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Chionactis occipitalis (Hallowell)
Western Shovel-Nosed Snake

Rhinostoma occipitale Hallowell 1854:95. Type locality, "Mohave Desert" (= in the region of the Mojave River, western San Bernardino County, California). Holotype cannot be located, but is figured in Hallowell (1859: plate IV, fig. 2a–c).
Lamprosoma occipitale: Hallowell 1856:311.
Chionactis occipitale: Cope 1860:241. First use of combination.
Chionactis occipitalis: Cooper 1870:66. First use of current combination.
Homalosoma occipitale: Müller 1882:125.
Contia occipitalis: Garman 1884a:91.
Contia occipitale: Brown 1901:68 (part).
Chioractis occipitalis: Meek 1905:15. Incorrect subsequent spelling.
Sonora occipitalis: Van Denburgh and Slevin 1913:412 (part).

• **CONTENT.** Four subspecies are currently recognized: *Chionactis occipitalis occipitalis*, *C. o. annulata*, *C. o. klauberi*, and *C. o. talpina.*

• **DEFINITION.** *Chionactis occipitalis* is a small colubrid snake with a maximum recorded TL of a live specimen of 425 mm (Klauber 1951). Scutellation is as follows: dorsal scale rows 15–15–15; ventrals 146–176 (146–165, males; 154–176, females); subcaudals 37–50 (39–50, males; 37–48, females); supralabials 6–7 (usually 7); infralabials 6–8 (usually 7); loreal single; preocular single (rarely divided); postoculars 1–3 (usually 2); temporals 1 + 2 (rarely 1 + 1, 1 + 3, or 2 + 2). Dorsal scale rows frequently number 17 on the neck and, rarely, 13 immediately before the anal plate (cloacal scute). Subcaudals are divided, although occasionally they are undivided at the base of the tail. The rostral plate does not separate the internasals and is deeply cleft on the underside. Rarely, one or both loreals are fused with the prefrontals. The third and fourth supralabials contact the orbit and the sixth is the largest. The dorsal scales are smooth and possess a single apical pit. The pupil is round.

Dorsal ground color is white, yellow, cream, or pale orange on body and tail. The medium to dark brown crossbands on the body range from 18–41, usually 21 or more, and the tail has 4–14 pale brown rings. The bands may be wider than, equal to, or narrower than the interspaces; each band is reduced in width dorsolaterally. The bands are usually even-edged. Lateral spots in the interspaces are infrequent and appear as dark edges on some of the scales. A conspicuous dark brown head crescent engages, to some degree, the parietal and frontal scales. The anterior edge of the crescent is usually smoothly rounded and concave, although it may be "U-", "V-", or "lyre-shaped" in appearance. On each side of the head, the anterior limit of the lateral horns of the crescent may encroach upon the preocular, loreal, or nasal scales. The ventral surface is pale buff or ivory yellow and may possess pale brown bands (Klauber 1951, Cross 1979).

• **DIAGNOSIS.** *Chionactis occipitalis* is distinguished from *C. palarostris* by possessing a longer, flat-topped, or slightly concave snout; a black, usually crescent-shaped mark on top of the head; usually 21 or more dark bands on the body; and narrow (or absent), rather than broad, red saddles between the dark bands on the body and tail (Mahrdt et al. 2001).



FIGURE 1. *Chionactis occipitalis annulata* from Borrego Springs, San Diego County, California (photograph by L.L. Grismer).



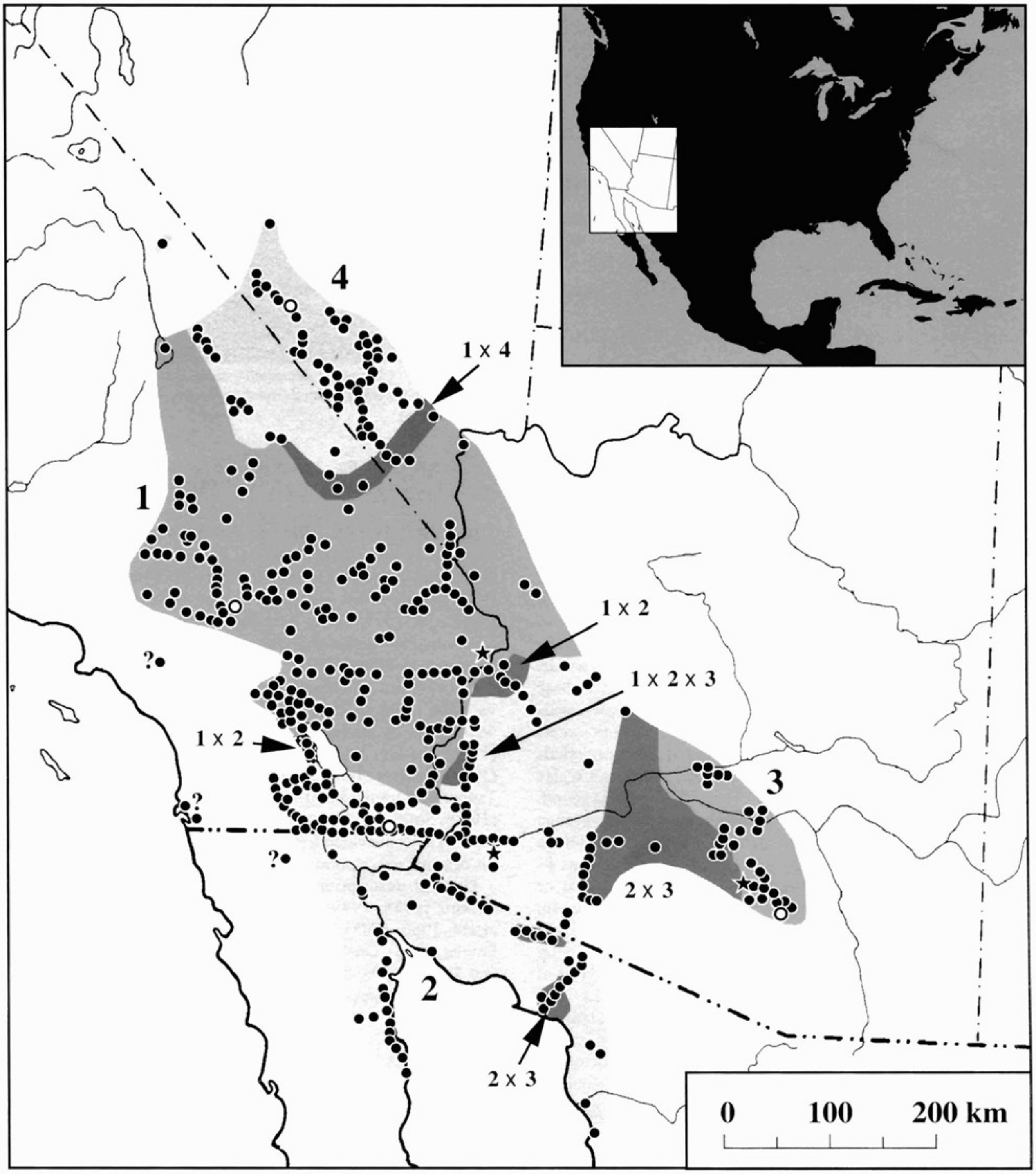
FIGURE 2. *Chionactis occipitalis occipitalis* from near Porcupine Wash, Kingston Range, San Bernardino County, California (photograph by C. Brown).

• **DESCRIPTIONS.** The original description of *Chionactis occipitalis* was published by Hallowell (1854). Early descriptions appeared in Baird (1859a), Hallowell (1859), Cope (1861, 1892, 1900), Garman (1884a), Boulenger (1894), Van Denburgh (1897, 1922), and Brown (1901). Comprehensive taxonomic revisions and character analysis of *C. occipitalis* appeared in Stickel (1938, 1941, 1943), Klauber (1951), and Cross (1979). Comments on color pattern, scutellation, and variation within specific geographic populations of *C. occipitalis* were given by Richardson (1910), Van Denburgh and Slevin (1913), Camp (1916), Klauber (1931, 1934), Burger and Hensley (1949), Hensley (1950), Smith and Hensley (1958), Elvin (1963), Tanner and Jorgensen (1963), Tanner and Banta (1966), Cross (1970), Smith and Holland (1971), and Welsh and Bury (1984). Funk (1967) provided a general description of *C. occipitalis* in his original description of *C. saxatilis.*

General descriptions were published by Ditmars (1907), Perkins (1938, 1949a), Schmidt and Davis (1941), Stebbins (1954, 1966, 1985), Jaeger (1957), Wright and Wright (1957), Fowlie (1965), Cochran and Goin (1970), Brown (1974), Behler and King (1979), Smith and Brodie (1982), Mattison (1989), Macey and Papenfuss (1991), Brown (1997), and Grismer (2001).

• **ILLUSTRATIONS. Line drawings** of *C. occipitalis* were published by Baird (1859a,b), Hallowell (1859), Van Denburgh (1897), Cope (1900), Blanchard (1925), Schmidt and Davis (1941), Stebbins (1954, 1972), Jaeger (1957), Moore and Koch (1973), Marlow (1988), Brown (1997), and Ivanyi and Perry (2000). A line drawing of the lower jaw and rostral scale appeared in Casas Andreu and McCoy (1979). Line drawings of head crescent patterns and scale row fusion are in Cross (1979). Line drawings comparing the head shape of *C. occipitalis* to that of *C. palarostris* are in Powell et al. (1998).

Ballinger and Lynch (1988) presented a line drawing of the head shape of *Chionactis*. Dowling and Duellman (1974–1978) published line drawings of a vertebra, maxilla, and hemipenis of *C. occipitalis*. Norris and Kavanau (1966) published a line drawing showing a ventral view of the head and an anterior dorsolateral view of a burrowing *C. occipitalis*. Holman (1995) included the anterior dorsolateral view of a burrowing individual that first appeared in Norris and Kavanau (1966). Banta (1957) published a line drawing of *C. occipitalis* in a pitfall trap. **Color illustrations** of *C. occipitalis* appeared in Brown (1974), Simon (1979), Behler and King (1979), Smith and Brodie (1982), and Stebbins (1966, 1985). **Black and white photographs** of *C. occipitalis* appeared in Van Denburgh (1922), Ditmars (1939), Stickel (1941), Pickwell (1947), Cowles (1949), Perkins (1938, 1949a), Klauber (1951), Hecht and Marien (1956), Wright and Wright (1957), Jaeger (1961), Horstman (1964), Fowlie (1965), Brame (1973), Breen (1974), Stoops and Wright (1993), Stewart (1994), and Flaxington (1998). A photograph of the karyotype



MAP. Distribution of *Chionactis occipitalis*. Circles indicate type localities of *C. o. occipitalis* and *C. o. annulata* defined by Klauber (1951) and Smith and Taylor (1950), respectively. Dots indicate other known localities and those outside the shaded area are extralimital; some dots represent two or more proximate localities or several individuals. Stars indicate fossil record sites taken from the literature. Question marks indicate records of uncertain validity. All localities plotted are based on museum and literature records; the authors did not examine all museum specimens to validate identification.

of *C. occipitalis* was published by Bury et al. (1970) and photomicrographs of skin sections by Chiu and Lynn (1970). Mitchell (1978) published a black and white photograph of defensive balling behavior. Black and white photographs of tracks made by *C. occipitalis* in sand appeared in Mosauer (1935) and Cowles (1941a, 1949, 1977). **Color photographs** of live specimens of *C. occipitalis* were published by Cochran and Goin (1970), Anonymous (1971), Shaw and Campbell (1974), Heymann (1975), Switak (1978, 1984, 1986, 1993), Grater (1981), Lowe et al. (1986), Alvarez Solórzano and Gonzalez (1987), Mehrtens (1987), Campbell and Lamar (1989), Mattison (1989), Coborn (1991), Macey and Papenfuss (1991), Schoenherr (1992), Stoops and Wright (1993), Arizona Game and Fish (1993), Scott (1996), Brown (1997), Hanson and Hanson (1997), Loza (1999), Bartlett and Tennant (2000), Holman (2000), McPeak (2000), and Grismer (2001). A color photograph that appeared in Grater (1981) is not of *C. occipitalis*, but of *Sonora semiannulata*. Scott (1996) published a color photograph showing a color phase of a live *C. occipitalis* from Borrego Desert, San Diego County, California. A color photograph showing the shovelnosed snout appeared in Loza (1999). **Photographs of habitat** are in Klauber (1931), Mosauer (1933, 1935), Slevin (1951), Funk (1967), Switak (1978, 1984, 1986, 1993), and Mattison (1989).

• DISTRIBUTION. *Chionactis occipitalis* occurs in the Mojave and Sonoran deserts in southern Nevada (Clark, Esmeralda, and Nye counties), southern California (Imperial, Inyo, Kern, Los Angeles, Riverside, San Bernardino, and San Diego counties), southwestern Arizona (La Paz, Maricopa, Mohave, Pima, Pinal, Yavapai, and Yuma counties), and northwestern Sonora and extreme northeastern Baja California, México. This species occurs in dry desert habitats, including sandy dunes, desert washes and valleys, and bajadas, from below sea level to nearly 1500 m in elevation. It is found most frequently in sparsely vegetated, sandy to gravelly habitats, and is less abundant in rocky terrain. This species occasionally inhabits transitional upland desert of ecotonal juniper woodland and chaparral plant communities in southern California. Great Basin populations prefer open sagebrush and creosote vegetation below pinon-juniper woodland (Banta 1953, Tanner and Jorgensen 1963). *Chionactis occipitalis* was considered rare prior to 1930, before the construction of asphalt roads and the use of the automobile as an effective collecting method (Gloyd 1937b, 1940; Klauber 1939). Most museum locality records are associated with or in close proximity to paved roads.

Published distributional records and range extensions appeared in Stephens (1918, San Diego County, California), Klauber (1931, 1934, southern California border region), Cowles and Bogert (1936, Clark County, Nevada), Lindsdale (1940, Clark County, Nevada), Hensley (1950, Pima County, Arizona), Banta (1953, Nye County, Nevada), Gates (1957, Maricopa County, Arizona), Smith and Hensley (1958, Sonora, México), Banta (1962, Inyo County, California), Loomis and Stephens (1962, 1967, Joshua Tree National Park, California), Elvin (1963, Inyo County, California and Nye County, Nevada), Tanner and Jorgensen (1963, Nevada Test Site, Nevada), Turner and Wauer (1963, Death Valley region, California), Wake (1966, Baja California, Mexico), Cross (1970, Baja California, México), Glaser (1970, Riverside County, California), Smith and Holland (1971, Baja California, México), Vitt and Ohmart (1978, lower Colorado River), Grismer (1989, 1997, 2001, Baja California, México), Flaxington (1998, southern California), and Morrrison and Hall (1999, Inyo County, California).

Range maps have been published previously in Stebbins (1954, 1966, 1985), Wright and Wright (1957), Savage (1959),

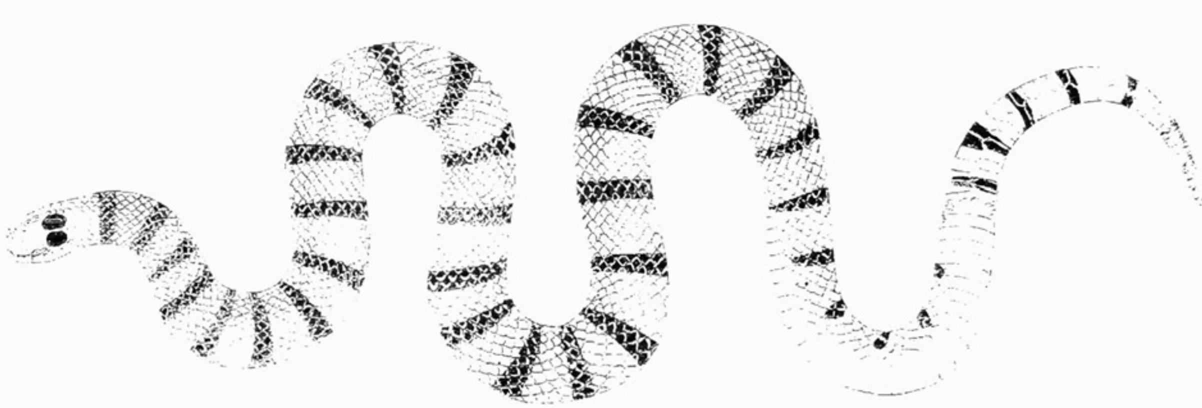


FIGURE 3. Line drawing of Hallowell's type specimen of *Lamprosoma occipitale* (= *Chionactis occipitalis*) from the "Mohave Desert" as it appeared in Baird (1859).



FIGURE 4. Line drawing of the cotype of *Lamprosoma annulatum* (= *Chionactis occipitalis annulata*) as it appeared in Baird (1859).

Fowlie (1965), Shaw and Campbell (1974), Behler and King (1979), Smith and Brodie (1982), Marlow (1988), Macy and Papenfuss (1991), Brown (1997), Bartlett and Tennant (2000), and Grismer (2001).

• **FOSSIL RECORD.** Van Devender and Mead (1978) reported the first fossil records of *C. occipitalis* from six woodrat middens located in the Whipple Mountains, California, and Wellton Hills and Silver Bell Mountains, Arizona. The middens contained fossil vertebrae from the Middle Holocene. Holman (1981, 2000) gave the distribution as Rancholabrean II to Early to Middle Holocene of Arizona and California. Holman (1995) included *C. occipitalis* as the only known Pleistocene fossil of the genus with records from Wolcott Peak, Pima County, and Wellton Hills, Yuma County, Arizona and Redtail Peaks and Whipple Mountain, San Bernardino County, California.

• **PERTINENT LITERATURE.** Stickel (1941), Klauber (1951), and Cross (1979) presented **comprehensive reviews** and discussion of subspecific differentiation within *C. occipitalis*. Klauber (1941, 1943, 1945) used statistical methods for analyses of various morphological characters within the species. Analyses of **dorsal scale microdermatoglyphics** by Price (1982) and Price and Kelly (1989) included *C. occipitalis*. Remarks regarding **systematics, evolution, and biogeography** appeared in Cope (1869, 1875, 1896), Cross (1970), Marx and Rabb (1972), Dowling (1975b), Mares et al. (1977), Murphy (1976, 1982, 1983a, 1983b), Blackburn (1985), Macey (1986), Welsh (1976, 1988), Van Devender (1990), Grismer (1990, 1994a, 1994b), and Goyenechea (2000). The **karyotype** (2n = 36) **and chromosome morphology** were described by Bury et al. (1970), Trinco and Smith (1972), and Gilboa (1975). Characteristics of the **teeth** were discussed by Stebbins (1954) and Dowling (1975b).

Publications on various aspects of the biology of *C. occipitalis* are as follows: **anatomy** (Miller 1968, Saiff 1975, Van Devender et al. 1985), **antipredator and escape strategies** (Warren 1953; Jackson et al. 1976; Mitchell 1978; Greene 1973, 1988; Cloudsley-Thompson 1994; Diwan and Arora 1995), **captive management** (Switak 1973, 1984), **conservation and economic importance** (Brattstrom 1994), **food habits** (Cowles 1941b, Klauber 1951, Cunningham 1959, Funk 1967, Glass 1972, Mushinsky 1987), **locomotion and "sand swimming" behavior** (Mosauer 1932, 1933, 1936; Bogert 1939; Oliver 1955; Norris and Kavanau 1966; Cloudsley-Thompson 1971, 1994; Klauber 1972; Switak 1978, 1986, 1993; Mehrtens 1987; Pough et al. 1998), **male combat behavior** (Goode and Schuett 1994), **melanism** (Norris 1967), **mimicry** (Cope 1869; Brattstrom 1955; Hecht and Marien 1956; Mertens 1956; Anonymous 1971; Gelbach 1981; Grobman 1978; Russell 1980, 1983; Pough 1988; Campbell and Lamar 1989), **parasitology** (Powder and Loomis 1962, Hoffman 1990), **physiology** (Chiu and Lynn 1970, 1971; Cohen 1975; Bennett and Dawson 1976; Mautz 1982), **population density** (Turner 1977), **predation** (Klauber 1951, Anderson 1956, Funk 1965, Vitt and Hulse 1973, Mahrdt and Banta 1996), **repro-duction** (Cowles 1941a, Hensley 1950, Klauber 1951, Funk 1967, Goldberg 1997, Goldberg and Rosen 1999), **seasonal activity and hibernation** (Cowles 1920, 1941a; Cowles and Bogert 1944; Klauber 1939, 1946, 1951; Brattstrom 1952; Shaw 1953; Banta 1962; Elvin 1963; Cloudsley-Thompson 1971; Mushinsky 1987), **stereotyped behavior** (Ferguson 1977, Carpenter and Ferguson 1977), and **thermal requirements** (Cowles 1941a, Cowles and Bogert 1944, Brattstrom 1965, Cunningham 1966, Grassé 1970, Goin and Goin 1971, Avery 1982, Gregory 1982, Lillywhite 1987). Mosauer (1935) described **morphological and behavioral adaptations** to inhabiting a sand environment. Pough (1969) proposed that the concave ventral surface may serve as an adaptation to respiration in burrowing *C. occipitalis*. Klauber (1940) briefly described similarities in head shape and burrowing behavior of *Anniella pulchra* to that of *Chionactis occipitalis*. Dial et al. (1989) examined **chemosensory cues** used by *Coleonyx variegatus* to identify *C. occipitalis* in the laboratory. Observations on **diurnal activity** appeared in Cowles (1920, 1949), VanDenburgh (1922), Klauber (1939, 1951), Brattstrom (1952), and Mahrdt and Banta (1996). Norris and Kavanau (1966) examined the relationships of air temperature and sand pressure to **subsurface activity patterns**. **Highway mortality** and its impact on *C. occipitalis* populations was discussed by Klauber (1931, 1939), Hubbs and Walker (1947), and Rosen and Lowe (1994). Aspects of **ecology** and the status of Arizona populations were examined by Lowe and Rosen (1992), Rosen and Lowe (1996), and Rosen et al. (1996). Descriptions of **habitat** appeared in Cooper (1870), Camp (1916), Grinnell and Camp (1917), Hall and Grinnell (1919), Cowles (1920, 1941a), Stephens (1921), Mosauer (1935), Gloyd (1937a), Bogert (1939), Dice (1939), Klauber (1932a, 1939, 1951), Banta (1953), Warren



FIGURE 5. Dorsal view (upper) and ventral view (lower) of the preserved holotype (MCZ 77039) of *Chionactis saxatilis* (adult male, SVL 272 mm) from 4 km NE of Fortuna Mine, Gila Mountains, Yuma County, Arizona (photograph by D. Meier). See **Comments**.

(1953), Allred et al. (1963), Elvin (1963), Tanner and Jorgensen (1963), Turner and Wauer (1963), Lowe (1964), Funk (1967), Telford (1970), Fritts (1978), Johnson et al. (1979), Seib (1980), Gehlbach (1981), Leavell (1981), Brown (1983), Ford et al. (1983), Mayhew (1983), Papenfuss (1986), Moon (1988), Gonzalez-Romero and Alvarez-Cardenas (1989), and Stewart (1994).

Geographic checklists and species accounts of *C. occipitalis* are in Heermann (1859), Cope (1866, 1875, 1896), Coues (1875), Müller (1882), Yarrow (1882), Garman (1884b), Meek (1905), Van Denburgh and Slevin (1913), Grinnell and Camp (1917), Stejneger and Barbour (1917, 1923, 1933, 1939, 1943), Stephens (1921), Schmidt (1922, 1953), Klauber (1924, 1926, 1928, 1930, 1932b, 1934), Slevin (1934), Cowles and Bogert (1936), Perkins (1938, 1949a), Linsdale (1940), Bogert and Oliver (1945), Smith and Taylor (1945), Wright and Wright (1952), Conant et al. (1956), Gates (1957), Loomis and Stephens (1962, 1967), Slama (1963), Horstman (1964), Banta (1965a), Bradley and Deacon (1965), Fowlie (1965), Glaser (1970), Moore and Koch (1973), Loomis et al. (1974), Dowling (1975a), Murphy (1976), Vitt and Ohmart (1978), Collins et al. (1978, 1982), Frost (1979), Grater (1981), Endemic Species Committees (1982), Jennings (1983, 1987), Marlow (1988), Flores-Villela and Gomez (1989), Collins (1990, 1997), Laudenslayer et al. (1991), Arizona Game and Fish (1993), Flores-Villela (1993), Frank and Ramus (1995), Greene and Luke (1996), Hanson and Hanson (1997), McPeak (2000), Ivanyi and Perry (2000), and Grismer (2001). *Chionactis occipitalis* appears in **taxonomic keys** by Cope (1887), Blanchard (1925), Stickel (1938), Perkins (1940, 1949b), Savage (1948, 1949, 1959), Slama (1963), Smith and Taylor (1966), Cagle (1968), Sanborn and Loomis (1976), DeLisle (1978), Casas Andreau and McCoy (1979), Ballinger and Lynch (1988), and Powell et al. (1998); and in **bibliographies** by Banta (1965b) and Smith and Smith (1973, 1976). Beltz (1995) included *C. occipitalis* in a list of citations for the original descriptions of amphibians and reptiles of North America. Type specimens of *C. occipitalis* were listed by Slevin and Leviton (1956), Cochran (1961), Sloan (1965), and Pregill and Berrian (1984).

General accounts on various aspects of **natural history** were published by Pickwell (1947), Cowles (1949), Ditmars (1951), Miller and Stebbins (1964), Schmidt et al. (1971), Leviton (1972), Shaw and Campbell (1974), Engelmann and Obst (1981), Mehrtens (1987), Burton (1991), Macey and Papenfuss (1991), Brazaitis and Watanabe (1992), Greene (1997), Brown (1997), Bartlett and Tennant (2000), Ivanyi and Perry (2000), and Grismer (2001).

• **REMARKS.** The type specimen of *Chionactis occipitalis* (Hallowell 1854) was collected by A.L. Herrmann (from the "Mohave Desert") in 1853 on the Pacific Railroad Expedition, under the command of Lt. R.S. Williamson. The type may have been discovered in the region of the Mohave River, southwestern San Bernardino County, California, based on the localities where other reptiles are known to have been collected on the expedition (see Klauber 1951). Although the type specimen was deposited in the Smithsonian Institution, as reported by Hallowell (1856), no USNM catalogue number references this specimen. In addition, no mention of Hallowell's type specimen is made by Cochran (1961), nor is it listed in the lost type file at USNM (G. Zug, in litt., 1997). Whether Cope (1860) examined the type or used Hallowell's 1854 original description is total speculation. Presumably, if Cope had examined the type, its deposition would have been the Academy of Natural Sciences of Philadelphia. Only a single line drawing of the type exists (Hallowell 1859: plate IV). Hallowell did not provide the sex of the type; however, the low subcaudal count suggests that it was a female. Two specimens collected in 1855 by A. Schott (from the "Colorado Desert") during the United States and Mexican Boundary Survey were reported by Baird (1859a) as USNM 2105–6 and listed by Cochran (1961) as cotypes. Cope (1892, 1900) and Klauber (1951) listed both specimens as USNM 2105. Two specimens, USNM 2105A and B are considered the types of Baird's *Lamprosoma annulatum* (= *Chionactis occipitalis annulata*), although USNM 2105 was originally catalogued as a single specimen and USNM 2106 is not present in the collection (G. Zug, in litt., 1997).

Flores-Villela and Fernandez (1988) inadvertently excluded *C. occipitalis* from their checklist of the herpetofauna of Mexico. Cross (1970) allegedly reported the first record of *C. occipitalis* from Baja California; however, Wake (1966) reported this species from 36 miles north of San Felipe, Baja California, from a specimen (LACM 25063) collected in 1961.

Van Devender et al. (1991) referred to *C. occidentalis* from the middle Holocene and late Wisconsin from the Sonoran Desert in Arizona and California. This appears to be in error, since publications by Van Devender and Mead (1978) and Holman (1981) both contained the spelling *occipitalis*.

Lowe (unpubl. field notes) found the remains of a *C. occipitalis* in a pellet of a great horned owl collected from the Mohawk Dunes, Yuma County, Arizona in August 1980.

• **ETYMOLOGY.** The name *occipitalis* is derived from the Latin *occipit* meaning the back of the head, in reference to "the occipital crescent blotch" (Baird 1859a). The name *annulata* is derived from the Latin *annulus* meaning "like a ring," referring to this subspecies' banded or ringed pattern. The name *klauberi* is a patronym honoring Lawrence M. Klauber, a colleague of William H. Stickel, who described the taxon. The name *talpina* is derived from the Latin *talpa*, meaning "mole," in reference to the fossorial habit of this subspecies.

• **COMMENTS.** The present taxonomy of *C. occipitalis* is uncertain and highly problematic, due, in large part, to the extensive variation that is exhibited among individuals and populations in color pattern throughout the species' range. Four subspecies of *C. occipitalis* are currently recognized. Although Stickel (1943) and Klauber (1951) provided extensive treatments of the genus, Cross (1979) was the first to provide a detailed analysis of geographic variation. Both univariate and multivariate analyses were applied to 39 characters, including color pattern and morphology, based on 1507 specimens from 32 populations representing the entire range of the genus. Cross (1979) concurred with the conclusions of Klauber (1951). However, most populations are not completely diagnosable and intergrade widely throughout the range of *C. occipitalis*. We suspect that most populations of *C. occipitalis* represent only color pattern ecomorphs and that the current designations of subspecies provide little support for elucidating the evolutionary history of the taxa. The systematics and phylogeography of *Chionactis*, especially that of *C. occipitalis*, require further investigation.

Since the description of *C. saxatilis* by Funk (1967), few authors have included this species in checklists and field guides (Dowling 1975a; Smith and Brodie 1982; Collins 1990, 1997; Beltz 1995; Holman 1995). Blake (1970), unable to directly examine the paratypes of *C. saxatilis*, later questioned the "circumstances surrounding the description" and did not recognize the validity of this species. Blake (in litt., 1967) requested a loan of the paratypes; however, Funk's paratype series existed only as a table of scale characters and measurements, which Blake apparently had reviewed (Funk, in litt., 1967). Later, Mattison (1989), without comment, indicated that possibly the species had been suppressed. Recently, Powell et al., (1997) chose to omit *C. saxatilis* from a key to the

amphibians and reptiles of the United States, based on evidence that suggests the taxon is invalid. Cross (1979) provided a historical overview and comprehensive case for the suppression of *C. saxatilis*. In his conclusion, he stated "there is no doubt whatsoever that the name *Chionactis saxatilis* is a junior synonym of *Chionactis occipitalis annulata*." The holotype (MCZ 77039), collected 4.0 air km northeast of Fortuna Mine in the Gila Mountains, Yuma County, Arizona, was the only available specimen examined by Cross; 22 paratypes, including 10 hatchlings, were reported, but their disappearence remains a mystery. Two of the authors (CRM and KRB) have examined the holotype and a list of paratypic data of Funk (in litt., 1967), in addition to 11 specimens collected in the vicinity of the Gila Mountains. The eight characters used by Funk are not diagnostic and we conclude that *C. saxatilis* is strictly a pattern class of *C. o. annulata*. *Chionactis saxatilis*, therefore, is placed in synonomy with *C. o. annulata*.

1. *Chionactis occipitalis occipitalis* (Hallowell)
Mojave Shovel-Nosed Snake

Rhinostoma occipitale Hallowell 1854:95. See species synonymy.
Chionactis occipitalis occipitalis: Cope 1875:35. First use of present combination.
Contia occipitalis var. *occipitalis*: Garman 1884a:91.
Sonora occipitalis occipitalis: Stickel 1941:135.

• **DEFINITION.** This subspecies is characterized by having ventral scale counts of 146–165 in males and 154–176 in females. Subcaudal scale counts are 39–50 in males and 37–48 in females. The brown primary crossbands number 25–41 on the body and 6–14 on the tail. Dark maculations in the dorsal interspaces are usually absent or, if present, are restricted to the scale edges. The narrow red crossbands are absent, and anterior bands cross the venter to form complete rings.

2. *Chionactis occipitalis annulata* (Baird)
Colorado Desert Shovel-Nosed Snake

Lamprosoma occiptale Kennicott *in* Baird 1859a:21.
Lamprosoma annulatum Baird 1859a:22. Type locality, "Colorado Desert," restricted to "near Holtville, Imperial County, California" by Smith and Taylor (1950). Cotypes, National Museum of Natural History (USNM) 2105a and 2105b, two specimens collected by A. Schott, year of collection 1855 (not examined by authors).
Chionactis occipitalis annulata: Cope 1875:36. First use of present combination.
Contia occipitalis var. *annulata*: Garman 1884a:91.
Chionactis occipitalis annulatus: Cope 1900:943.
Sonora occipitalis annulata: Stickel 1941:136.
Chionactis saxatilis Funk 1967:180. Type locality, "Gila Mountains, Yuma Co., Ariz., ca. 2.5 air miles northeast (in T.10S., R.20W.) of Fortuna Mine at an elevation of ca. 2300 feet above sea level." Holotype, formerly in the private collection of Richard S. Funk (RSF 349), now Museum of Comparative Zoology (MCZ 77039), adult male collected by R.S. Funk on 13 August 1961 (examined by CRM and KRB). See **Comment**.
Chionactis occipitalis saxatilis: Smith and Brodie 1982:168.

• **DEFINITION.** This subspecies is characterized by having ventral scale counts of 143–164 in males and 153–178 in females. Subcaudal scale counts are 40–57 in males and 34–51 in females. The black primary crossbands number 18–35 on the body and 4–12 on the tail. Dark maculations in the interspaces usually are absent. Narrow red cross bands are present and anterior black bands cross the venter to form complete rings.

3. *Chionactis occipitalis klauberi* (Stickel)
Tucson Shovel-Nosed Snake

Sonora occipitalis klauberi Stickel 1941:138. Type locality, "Tucson, Pima County, Arizona." Holotype, formerly in the private collection of Laurence M. Klauber (LMK) 29647, now San Diego Society of Natural History (SDSNH) 29647, an adult male collected by C.T. Vorhies on 3 June 1938 (examined by CRM).
Chionactis occipitalis klauberi: Stickel 1943:124.

• **DEFINITION.** This subspecies is characterized by having ventral scale counts of 141–151 in males and 153–159 in females. Subcaudal scale counts are 42–47 in males and 38–43 in females. The black or dark brown primary bands number 23–29 on the body and 7–11 on the tail. Black or brown secondary bands are present on the interspaces and do not contact the venter. The interspaces usually possess maculated scale centers.

4. *Chionactis occipitalis talpina* Klauber
Nevada Shovel-Nosed Snake

Chionactis occipitalis talpina Klauber 1951:172. Type locality, "50 miles south of Goldfield on the highway to Beatty, in Nye County, Nevada." Holotype, California Academy of Sciences (CAS) 81364, adult male collected by Joseph R. Slevin and Wallace Wood on 3 June 1947 (not examined by authors).

• **DEFINITION.** This subspecies is characterized by having ventral scale counts of 148–162 in males and 157–176 in females. Subcaudal scale counts are 44–51 in males and 43–48 in females. Brown primary bands on the body number 23–39 and 6–13 on the tail. Dark pigmentation or maculations in the interspaces are usually present, and posterior primary bands usually encircle the body.

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LITERATURE CITED

Allred, D.M., D.E. Beck, and C.D. Jorgensen. 1963. Biotic communities of the Nevada Test Site. Brigham Young Univ. Sci. Bull., Biol. Ser. 2:1–52.
Alvarez Solórzano, T. and M. Gonzalez. 1987. Atlas Cultural de México. Fauna. Inst. Nac. Anthropol. Hist., México.
Anderson, J.D. 1956. A blind snake preyed upon by a scorpion. Herpetologica 12:327.
Anonymous. 1971. Friend or foe? Zoonooz 44:18–19.
Arizona Game and Fish Department. 1993. Herps of Arizona. Arizona Wildlife Views, Spec. Ed. 36:1–36.
Avery, R.A. 1982. Field studies of body temperatures and thermoregulation, p. 93–166. *In* C. Gans and F.H. Pough (eds.), Biology of the Reptilia. Vol. 12. Physiology C. Acad. Press, New York.
Baird, S.F. 1859a. Reptiles of the Boundary, with Notes by the Naturalists of the Survey. United States and Mexican Boundary Survey under Order of Lieut. Col. W.H. Emory. Washington, D.C. Vol. 2:1–35.
—. 1859b. General Report upon the Zoology of the Railroad Routes

from the Mississippi River to the Pacific Ocean: Reptiles (Humphreys Route). Washington, D.C. Vol. 10:9–16.
Ballinger, R.E. and J.D. Lynch. 1988. How to Know the Amphibians and Reptiles. Wm. C. Brown, Dubuque, Iowa.
Banta, B.H. 1953. Some herpetological notes from southern Nevada. Herpetologica 9:75–76.
—. 1957. A simple trap for collecting desert reptiles. Herpetologica 13:174–176.
—. 1962. A preliminary account of the herpetofauna of the Saline Valley hydrographic basin, Inyo County, California. Wasmann J. Biol. 20: 161–251.
—. 1965a. A distributional check list of the recent reptiles inhabiting the state of Nevada. Occ. Pap. Biol. Soc. Nevada (5):1–8.
—. 1965b. An annotated chronological bibliography of the herpetology of the state of Nevada. Wasmann J. Biol. 23:1–224.
Bartlett, R.D. and A. Tennant. 2000. Snakes of North America: Western Region. Gulf Publ. Co., Houston, Texas.
Behler, J.L. and F.W. King. 1979. The Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, Inc., New York.
Beltz, E. 1995. Citations for the original descriptions of North American amphibians and reptiles. SSAR Herpetol. Circ. (24):1–44.
Bennett, A.F. and W.R. Dawson. 1976. Metabolism, p. 127–223. *In* C. Gans and W. Dawson (eds.), Biology of the Reptilia. Vol. 5. Physiology. Acad. Press, New York.
Blackburn, D.G. 1985. Evolutionary origins of viviparity in reptilia. II. Serpentes, Amphisbaenia, and Ichthyosauria. Amphibia-Reptilia 6: 259–291.
Blanchard, F.N. 1925. A key to the snakes of the United States, Canada and Lower California. Pap. Michigan Acad. Sci. Arts Lett. 4:xiii + 65 p.
Bogert, C.M. 1939. Reptiles under the sun. Nat. Hist. 44:26–37.
— and J.A. Oliver. 1945. A preliminary analysis of the herpetofauna of Sonora. Bull. Amer. Mus. Nat. Hist. 83:297–426.
Boulenger, G.A. 1894. Catalogue of the Snakes in the British Museum (Natural History). Vol. 2. Trustees Brit. Mus., London.
Bradley, W.G. and J.E. Deacon. 1965. The biotic communites of Southern Nevada. Desert Research Institute, Preprint No. 9, Univ. Nevada, Las Vegas.
Brame, A.H., Jr. 1973. Conservation Committee Report, Soutwestern Herpetologists' Society. HISS News-Journal 1:49–50.
Brattstrom, B.H. 1952. Diurnal activities of a nocturnal animal. Herpetologica 8:61–63.
—. 1955. The Coral Snake "mimic" problem and protective coloration. Evolution 9:217–219.
—. 1965. Body temperatures of reptiles. Amer. Midl. Nat. 73:376–422.
—. 1994. Social behavior and habitat requirements of desert reptiles, p. 127–142. *In* P.R. Brown and J.W. Wright (eds.), Herpetology of North American Deserts: Proceedings of a Symposium. Southwest. Herpetol. Soc. Spec. Publ. (5):iv + 311 p.
Brazaitis, P. and M.E. Watanabe. 1992. Snakes of the World. Crescent Books, New York.
Breen, J.F. 1974. Encyclopedia of Reptiles and Amphibians. T.F.H. Publ., Inc., Neptune City, New Jersey.
Brown, A.E. 1901. A review of the genera and species of snakes, north of Mexico. Proc. Acad. Nat. Sci. Philadelphia 53:10–110.
Brown, P.R. 1997. A Field Guide to Snakes of California. Gulf Publ. Co., Houston, Texas.
Brown, T.W. 1983. Fishes, Amphibians, and Reptiles of the Lower Mojave River System. U.S. Dept. Interior, Bur. Land Mgmt., Contract CA 060-CT8-000046, Riverside, California.
Brown, V. 1974. Reptiles and Amphibians of the West. Naturegraph Publ., Happy Camp, California.
Burger, W.L. and M.M. Hensley. 1949. Notes on a collection of reptiles and amphibians from northwestern Sonora. Nat. Hist. Misc. Chicago Acad. Sci. 35:1–6.
Burton, J.A. 1991. The Book of Snakes. Crescent Books, New York.
Bury, R.B., F. Gress, and G.C. Gorman. 1970. Karyotypic survey of some colubrid snakes from western North America. Herpetologica 26:461–466.
Cagle, F.R. 1968. Reptiles, p. 213–268. *In* W.F. Blair, A.P. Blair, P. Brodkorb, F.R. Cagle, and G.A. Moore (eds.), Vertebrates of the United States. McGraw-Hill Book Co., New York.
Camp, C.L. 1916. Notes on the local distribution and habits of the amphibians and reptiles of southeastern California in the vicinity of the Turtle Mountains. Univ. California Publ. Zool. 12:503–594.
Campbell, J.A. and W.W. Lamar. 1989. The Venomous Reptiles of Latin America. Cornell Univ. Press, Ithaca, New York.
Carpenter, C.C. and G.W. Ferguson. 1977. Variation and evolution of stereotyped behavior in reptiles. Part I. A survey of stereotyped reptilian behavioral patterns, p. 335–404. *In* C. Gans and D. Tinkle (eds.), Biology of the Reptilia. Vol. 7. Ecology and Behavior A. Acad. Press, New York.
Casas Andreu, G. and C.J. McCoy. 1979. Anfibios y Reptiles de México. Limusa, México.
Chiu, K.W. and W.G. Lynn. 1970. The role of the thyroid in skin shedding in the Shovel-nosed Snake, *Chionactis occipitalis*. Gen. Comp. Endocrinol. 14:467–474.
— and —. 1971. Further observations on the role of the thyroid in skin shedding in the Shovel-nosed Snake, *Chionactis occipitalis*. Gen. Comp. Endocrinol. 17:508–511.
Cloudsley-Thompson, J.L. 1971. The Temperature and Water Relations of Reptiles. Merrow Publ., Ltd., Watford Herts, London.
—. 1994. Predation and Defense Amongst Reptiles. R&A Publ., Ltd., Somerset, England.
Coborn, J. 1991. The Atlas of Snakes of the World. T.F.H. Publ., Neptune City, New Jersey.
Cochran, D.M. 1961. Type specimens of reptiles and amphibians in the U.S. National Museum. Bull. U.S. Natl. Mus. (220):1–291.
— and C.J. Goin. 1970. A New Field Book of Reptiles and Amphibians. G.P. Putnam's Sons, New York.
Cohen, A.C. 1975. Some factors affecting water economy in snakes. Comp. Biochem. Physiol. A. Comp. Physiol. 51:361–368.
Collins, J.T. 1990. Standard common and current scientific names for North American amphibians and reptiles. 3rd ed. SSAR Herpetol. Circ. (19):iii + 41 p.
—. 1997. Standard common and current scientific names for North American amphibians and reptiles. 4th ed. SSAR Herpetol. Circ. (25):iii + 40 p. (snakes names are updated regularly at www.naherpetology.org/nameslist.asp?id=6).
—, J.E. Huheey, J.L. Knight, and H.M. Smith. 1978. Standard common and current scientific names for North American amphibians and reptiles. SSAR Herpetol. Circ. (7):1–36.
—, R. Conant, J.E. Huheey, J.L. Knight, E.M. Rundquist, and H.M. Smith. 1982. Standard common and current scientific names for North American amphibians and reptiles. 2nd ed. SSAR Herpetol. Circ. (12):1–28.
Conant, R., F.R. Cagle, C.J. Goin, C.H. Lowe, W.T. Neill, M.G. Netting, K.P. Schmidt, C.E. Shaw, and R.C. Stebbins. 1956. Common names for North American amphibians and reptiles. Copeia 1956:172–185.
Cooper, J.G. 1870. The fauna of California and its geographical distribution. Proc. California Acad. Sci., Ser. 1, 4:61–81.
Cope, E.D. 1860. Catalogue of the Colubridae in the Museum of the Academy of Natural Sciences of Philadelphia, with notes and descriptions of new species. Part 2. Proc. Acad. Nat. Sci. Philadelphia 12:241–266.
—. 1861. Contributions to the ophiology of Lower California, Mexico and Central America. Proc. Acad. Nat. Sci. Philadelphia 18:292–306.
—. 1866. On the Reptilia and Batrachia of the Sonoran Province of the Nearctic Region. Proc. Acad. Nat. Sci. Philadelphia 18:300–314.
—. 1869 (1868). On the origin of genera. Proc. Acad. Nat. Sci. Philadelphia 20:242–300.
—. 1875. Checklist of North American Batrachia and Reptilia. Bull. U.S. Natl. Mus. (1):1–104.
—. 1887. Catalogue of batrachians and reptiles of Central America and Mexico. Bull. U.S. Natl. Mus. (32):1–98.
—. 1892. A critical review of the characters and variations of the snakes of North America. Proc. U.S. Natl. Mus. 14:589–694.
—. 1896. The geographical distribution of Batrachia and Reptilia in North America. Amer. Nat. 30:886–902, 1003–1026.
—. 1900. The crocodilians, lizards and snakes of North America. Ann. Rept. U.S. Natl. Mus. for 1898:153–1270.
Coues, E. 1875. Synopsis of the reptiles and batrachians of Arizona, with critical and field notes and an exaustive synonymy. *In* Report upon Geographical and Geological Explorations and Surveys West of the One Hundredth Meridian, in Charge of Lieut. Geo. M. Wheeler. Zoology 5:585–633.
Cowles, R.B. 1920. A list and some notes on the lizards and snakes represented in the Pomona College Museum. J. Entomol. Zool. 12:63–66.

—. 1941a. Observations on the winter activities of desert reptiles. Ecology 22:125–140.
—. 1941b. Evidence of venom in *Hypsiglena ochrorhynchus*. Copeia 1941:4–6.
—. 1949. Tracks in desert dunes. Nat. Hist. 58:206–212.
—. 1977. Desert Journal: Reflections of a Naturalist. Univ. California Press, Berkeley.
— and C.M. Bogert. 1936. The herpetology of the Boulder Dam region (Nev., Ariz., Utah). Herpetologica 1:33–42.
— and —. 1944. A preliminary study of the thermal requirements of desert reptiles. Bull. Amer. Mus. Nat. Hist. 83:265–296.
Cross, J.K. 1970. The Shovel-nosed Snake *Chionactis occipitalis* in Baja California. Herpetologica 26:134–140.
—. 1979. Multivariate and univariate character geography in *Chionactis* (Reptilia: Serpentes). Ph.D. Diss., Univ. Arizona, Tucson.
Cunningham, J.D. 1959. Reproduction and food of some California snakes. Herpetologica 15:17–19.
—. 1966. Additional observations on the body temperatures of reptiles. Herpetologica 22:184–189.
DeLisle, H.F. 1978. Key to the snakes of Baja California. Herpetology 9:11–20.
Dial, B.E., P.J. Weldon, and B. Curtis. 1989. Chemosensory identification of snake predators (*Phyllorhynchus decurtatus*) by Banded Geckos (*Coleonyx variegatus*). J. Herpetol. 23:224–229.
Dice, L.R. 1939. The Sonoran biotic province. Ecology 20:118–129.
Ditmars, R.L. 1907. The Reptile Book. Doubleday, Page & Co., New York.
—. 1939. A Field Book of North American Snakes. Doubleday & Co., Inc., Garden City, New York.
—. 1951. The Reptiles of North America: A Review of the Crocodilians, Lizards, Snakes, Turtles, and Tortoises Inhabiting the United States and Northern Mexico. Doubleday & Co., Inc., Garden City, New York.
Diwan, A.P. and D.K. Arora. 1995. Ecology of Reptiles. Anmol Publ. Pvt. Ltd., Darya Ganj, New Delhi.
Dowling, H.G. 1975a. A classification and checklist of the species of amphibians and reptiles found in the United States and Canada, p. 175–189. *In* H.G. Dowling (ed.), 1974 Yearbook of Herpetology, HISS Publ., New York.
—. 1975b. The Nearctic snake fauna, p. 190–202. *In* H.G. Dowling (ed.), 1974 Yearbook of Herpetology, HISS Publ., Amer. Mus. Nat. Hist., New York.
— and W.E. Duellman. 1974–1978. Subfamily Colubrinae, Holarctic terrestrial & arboreal snakes, p. 112c.1–112c.4. *In* H.G. Dowling and W.E. Duellman (eds.), Systematic Herpetology: A Synopsis of Families and Higher Categories. HISS Publ., New York.
Elvin, D.W. 1963. Variation and distribution of the Shovel-nosed Snakes (*Chionactis occipitalis*) in the northern Mojave Desert, California and Nevada. Herpetologica 19:73–76.
Endemic Species Committees. 1982. Endemic Amphibians and Reptiles of the Colorado River System: A Status Report. Colorado River Wildlife Council, Denver.
Engelmann, W. and F.J. Obst. 1981. Snakes: Biology, Behavior, and Relationship to Man. Exeter Books, New York.
Ferguson, G.W. 1977. Variation and evolution of stereotyped behavior in reptiles. Part II. Social displays of reptiles, p. 405–554. *In* C. Gans and D. Tinkle (eds.), Biology of the Reptilia. Vol. 7. Ecology and Behavior A. Acad. Press, New York.
Flaxington, W.C. 1998. Field Observations of California Amphibians and Reptiles. William C. Flaxington, Whittier, California.
Flores-Villela, O.A. 1993. Herpetofauna Mexicana. Lista anotada de las especies de anfibios y reptiles de México, cambios taxonómicos recientes, y nueva especies. Annotated list of the species of amphibians and reptiles of Mexico, recent taxonomic changes, and new species. Carnegie Mus. Nat. Hist. Specl. Publ. (17):iv + 73 p.
— and P.G. Fernández. 1988. Conservación en México: síntesis sobre vertebrados terrestres, vegetatión y uso del suelo. Inst. Nac. Invest. Recursos Bióticos, Xalapa, Veracruz, México.
— and J.A. Hernandez Gomez. 1989. Reptiles, p. 425. *In* J. Regelio Alvarez (dir.), Diccionario Enciclopédico de Baja California. Cia. Edit. Encicl., México.
Ford, R.S., C. B. Bush, and S. Charnley. 1983. Vertebrate fauna, p. 106–130. *In* R.D. Stone and V.A. Sumida (eds.), The Kingston Range of California: A Resource Survey, Publ. 10. Environmental Field Program, Univ. California, Santa Cruz.
Fowlie, J.A. 1965. The Snakes of Arizona. Azul Quinta Press, Fallbrook, California.
Frank, N. and E. Ramus. 1995. A Complete Guide to Scientific and Common Names of Reptiles and Amphibians of the World. NG Publ., Inc., Pottsville, Pennsylvania.
Fritts, T.H. 1978. Faunal Studies of the Reptiles and Amphibians of Southwest Imperial County, California. U.S. Dept. Interior, Bur. Land Mgmt., California Desert Plan Program, Riverside, California.
Frost, D.R. 1979. A checklist of the Arizona herpetofauna. Arizona Herpetol. Assoc. Newsl. 9:8–9.
Funk, R.S. 1965. Food of *Crotalus cerastes laterorepens* in Yuma County, Arizona. Herpetologica 21:15–17.
—. 1967. A new colubrid snake of the genus *Chionactis* from Arizona. Southwest. Nat. 12:180–188.
Garman, S. 1884a (1883). The reptiles and batrachians of North America, Pt. 1:Ophidia-Serpents. Mem. Mus. Comp. Zool., Harvard Univ. 8:xxi + 185 p.
—. 1884b. The North American reptiles and batrachians. A list of species occurring north of the isthmus of Tehuantepec, with references. Bull. Essex Inst. 16:1–46.
Gates, G.O. 1957. A study of the herpetofauna in the vicinity of Wickenburg, Maricopa County, Arizona. Trans. Kansas Acad. Sci. 60:403–418.
Gehlbach, F.R. 1981. Mountain Islands and Desert Seas. A Natural History of the U.S.-Mexico Borderlands. Texas A&M Univ. Press, College Station.
Gilboa, I. 1975. Karyotypes of amphibians and reptiles: a bibliographic review, p. 91–156. *In* H.G. Dowling (ed.), 1974 Yearbook of Herpetology, HISS Publ., Amer. Mus. Nat. Hist., New York.
Glaser, H.S.R. 1970. The distribution of amphibians and reptiles in Riverside County, California. Riverside Mus. Press, Nat. Hist. Ser. 1:1–40.
Glass, J.K. 1972. Feeding behavior of the Western Shovel-nosed Snake, *Chionactis occipitalis klauberi* with special reference to scorpions. Southwest. Nat. 16:445–447.
Gloyd, H.K. 1937a. A herpetological consideration of faunal areas in southern Arizona. Bull. Chicago Acad. Sci. 5:79–136.
—. 1937b. The Chicago Academy of Sciences Arizona Expedition April–June, 1937. Program Activities Chicago Acad. Sci. 8:1–26.
—. 1940. In saguaro land: An account of the Offield-Beaty Expedition of the Chicago Academy of Sciences May–June, 1940. Chicago Naturalist 3:111–124.
Goin, C.J. and O.B. Goin. 1971. Introduction to Herpetology. 2nd ed. W.H. Freeman, San Francisco, California.
Goldberg, S.R. 1997. Reproduction in the Western Shovelnose Snake, *Chionactis occipitalis* (Colubridae), from California. Great Basin Nat. 57:85–87.
— and P.C. Rosen. 1999. Reproduction in the Sonoran Shovelnose Snake (*Chionactis palarostris*) and the Western Shovelnose Snake (*Chionactis occipitalis*) (Serpentes: Colubridae). Texas J. Sci. 51:153–158.
González-Romero, A. and S. Alvarez-Cárdenas. 1989. Herpetofauna de la región del Pinacate, Sonora, México: un inventorio. Southwest. Nat. 34:519–526.
Goode, M.J. and G.W. Schuett. 1994. Male combat in the Western Shovelnose Snake (*Chionactis occipitalis*). Herpetol. Nat. Hist. 2: 115–117.
Goyenechea, I. 2000. Filogenia del genero *Conopsis* Gunther 1858 (Serpentes: Colubridae) con un analisis cladista del grupo de pequeñas culebras de norteamerica. Ph.D. Diss., Univ. Nac. Auto. México, Hidalgo.
Grassé, Pierre-P. 1970. Traité de Zoologie. Tome XIV. Reptiles. Glandes Endocrines - Embroyologie - Systematique - Paleontologie. (Fascicule III). Masson, Paris.
Grater, R.K. 1981. Snakes, Lizards, and Turtles of the Lake Mead Region. Southwest Parks and Monuments Assoc., Globe, Arizona.
Greene, H.W. 1973. Defensive tail display by snakes and amphisbaenians. J. Herpetol. 7:143–161.
—. 1988. Antipredator mechanisms in reptiles, p. 1–152. *In* C. Gans and R.B. Huey (eds.), Biology of the Reptilia. Vol. 16. Ecology B, Defense and Life History. Alan R. Liss, Inc., New York.
—. 1997. Snakes: The Evolution of Mystery in Nature. Univ. California Press, Berkeley.
— and C.A. Luke. 1996. Amphibian and reptile diversity in the East Mojave Desert, p. 53–58. In C. Luke, J. André, and M. Herring (eds.), Proceedings of the East Mojave Desert Symposium, 7–8 November

1992, University of California, Riverside. Tech. Reports No. 10, Nat. Hist. Mus. Los Angeles County, Los Angeles, California.

Gregory, P.T. 1982. Reptilian hibernation, p. 53–154. *In* C. Gans and F.H. Pough (eds.), Biology of the Reptilia. Vol. 13. Physiology D. Acad. Press, New York.

Grinnell, J. and C.L. Camp. 1917. A distributional list of the amphibians and reptiles of California. Univ. California Publ. Zool. 17:127–208.

Grismer, L.L. 1989. *Chionactis occipitalis annulata*. Geographic distribution. Herpetol. Rev. 20:13.

—. 1990. The reptiles and amphibians of Baja California. Tucson Herpetol. Soc. Newsl. 3:2–6.

—. 1994a. Ecogeography of the peninsular herpetofauna of Baja California, Mexico and its utility in historical biogeography, p. 89–125. *In* P.R. Brown and J.W. Wright (eds.), Herpetology of North American Deserts: Proceedings of a Symposium. Southwest. Herpetol. Soc. Spec. Publ. (5):iv + 311 p.

—. 1994b. The origin and evolution of the peninsular herpetofauna of Baja California, Mexico. Herpetol. Nat. Hist. 2:51–106.

—. 1997. The distribution of *Pituophis melanoleucus* and *P. vertebralis* in northern Baja California, Mexico. Herpetol. Rev. 28:68–70.

—. 2001. The Amphibians and Reptiles of Baja California, its Pacific Islands, and the Islands in the Sea of Cortes, Mexico: Natural History, Distribution and Identification. Univ. California Press, Berkeley (in press).

Grobman, A.B. 1978. An alternative solution to the Coral Snake mimic problem (Reptilia, Serpentes, Elapidae). J. Herpetol. 12:1–11.

Hall, H.M. and J. Grinnell. 1919. Life-zone indicators in California. Proc. California Acad. Sci., 4th Ser. 9:37–67.

Hallowell, E. 1854. Descriptions of new reptiles from California. Proc. Acad. Nat. Sci. Philadelphia 7:91–97.

—. 1856. Descriptions of a new genus of colubriform serpents from California. Proc. Acad. Nat. Sci. Philadelphia 8:310–311.

—. 1859. Report upon the Reptiles Collected on the Survey. Report on the Exploration and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean (Williamson Route). Washington, D.C. 10:1–23.

Hanson, J. and R.B. Hanson. 1997. 50 Common Reptiles and Amphibians of the Southwest. Southwest Parks and Monument Association, Tucson, Arizona.

Hecht, M.K. and D. Marien. 1956. The Coral Snake mimic problem: a reinterpretation. J. Morphol. 98:335–365.

Heermann, A.L. 1859. List of Reptiles Collected. Report on the Exploration and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean (Williamson Route). Washington, D.C. 10:24–25.

Hensley, M.M. 1950. Results of a herpetological reconnaissance in extreme southwestern Arizona and adjacent Sonora, with a description of a new subspecies of the Sonoran Whipsnake, *Masticophis bilineatus*. Trans. Kansas Acad. Sci. 53:270–288.

Heymann, M.M. 1975. Reptiles and Amphibians of the American Southwest. Doubleshoe Publ., Scottsdale, Arizona.

Hoffman, A. 1990. Los trombicúlidos de México (Acarida: Trombiculidae). Parte taxonómica. Inst. Biol. UNAM, Publ. Espec. (2):1–275.

Holman, J.A. 1981. A review of North American Pleistocene snakes. Publ. Mus. Michigan St. Univ., Paleontol. Ser. 1:261–306.

—. 1995. Pleistocene Amphibians and Reptiles in North America. Oxford Univ. Press, New York.

—. 2000. The Fossil Snakes of North America: Orgin, Evolution, Distribution, Paleoecology. Indiana Univ. Press, Bloomington.

Horstman, W.R. 1964. Harmless Snakes of Riverside County. Priv. printed, Riverside, California.

Hubbs, C.L. and B.W. Walker. 1947. Abundance of desert animals indicated by capture in fresh road tar. Ecology 28:464–466.

Ivanyi, C. and J. Perry. 2000. Western Shovel-nosed Snake (*Chionactis occipitalis*), p. 570. *In* S.J. Phillips and P.W. Comus (eds.), A Natural History of the Sonoran Desert. Arizona-Sonora Desert Museum Press, Tucson, and Univ. California Press, Berkeley.

Jackson, J.F., W. Ingram, III, and H. Campbell. 1976. The dorsal pigmentation pattern of snakes as an antipredator strategy: a multivariate approach. Amer. Nat. 110:1029–1053.

Jaeger, E.C. 1957. The North American Deserts. Stanford Univ. Press, Stanford, California.

—. 1961. Desert Wildlife. Stanford Univ. Press, Stanford, California.

Jennings, M.R. 1983. An annotated checklist of the amphibians and reptiles of California. California Dept. Fish Game 69:151–171.

—. 1987. Annotated check list of the amphibians and reptiles of California. 2nd rev. ed. Southwest. Herpetol. Soc., Spec. Publ. (3):1–48.

Johnson, R.K., L. Minden, and S.S. Salasky. 1979. Vertebrate fauna, p. 109–134. *In* B.A. Stein and S.F. Warrick (eds.), Granite Mountains Resource Survey, Publ. 1. Environmental Field Program, Univ. California, Santa Cruz.

Klauber, L.M. 1924. Notes on the distribution of snakes in San Diego, California. Bull. Zool. Soc. San Diego (1):1–23.

—. 1926. The snakes of San Diego County, California. Specimens collected for the Zoological Society Jan. 1, 1923 to Dec. 31, 1925. Copeia 1926:144.

—. 1928. A list of the amphibians and reptiles of San Diego County, California. Bull. Zool. Soc. San Diego (4):1–8.

—. 1930. A list of the amphibians and reptiles of San Diego County, California. 2nd ed. Bull. Zool. Soc. San Diego (5):1–8.

—. 1931. A statistical survey of the snakes of the southern border of California. Bull. Zool. Soc. San Diego (8):1–91.

—. 1932a. Notes on the Silvery Footless Lizard, *Anniella pulchra*. Copeia 1932:4–6.

—. 1932b. Amphibians and reptiles observed enroute to Hoover Dam. Copeia 1932:118–128.

—. 1934. Annotated list of the amphibians and reptiles of the southern border of California. Bull. Zool. Soc. San Diego (11):1–28.

—. 1939. Studies of reptile life in the arid southwest. Parts 1 and 2. Bull. Zool. Soc. San Diego (14):1–79.

—. 1940. Notes from a herpetological diary, II. Copeia 1940:15–18.

—. 1941. The frequency distribution of certain herpetological variables. Bull. Zool. Soc. San Diego (17):1–31.

—. 1943. Tail-length differences in snakes with notes on sexual dimorphism and the coefficient of divergence. Bull. Zool. Soc. San Diego (18):1–60.

—. 1945. Herpetological correlations I. Correlations in homogeneous populations. Bull. Zool. Soc. San Diego (21):1–101.

—. 1946. The Glossy Snake, *Arizona*, with descriptions of new subspecies. Trans. San Diego Soc. Nat. Hist. 10:311–398.

—. 1951. The Shovel-nosed Snake, *Chionactis*, with descriptions of two subspecies. Trans. San Diego Soc. Nat. Hist. 11:141–204.

—. 1972. Rattlesnakes: Their Hhabits, Life Histories and Influence on Mankind. 2nd ed. Univ. California Press, Berkeley.

Laudenslayer, W.F., Jr., W.E. Grenfell, Jr., and D.C. Zeiner. 1991. A check-list of the amphibians, reptiles, birds, and mammals of California. California Fish Game 77:109–141.

Leavell, C.Z. 1981. A survey of the herpetofauna at four sites in the western Colorado Desert. Bur. Land Mgmt., California Desert District, Riverside, California.

Leviton, A.E. 1972. Reptiles and Amphibians of North America. Doubleday & Co., Inc., New York.

Lillywhite, H.B. 1987. Temperature, energetics, and physiological ecology, p. 422–477. *In* R.A. Seigel, J.T. Collins, and S.S. Novak (eds.), Snakes: Ecology and Evolutionary Biology. McGraw-Hill Publ. Co., New York.

Linsdale, J.M. 1940. Amphibians and reptiles in Nevada. Proc. Amer. Acad. Arts Sci. 73:197–257.

Loomis, R.B. and R.C. Stephens. 1962. Records of snakes from Joshua Tree National Monument, California. Bull. So. California Acad. Sci. 61:29–36.

— and —. 1967. Additional notes on the snakes taken in or near Joshua Tree National Monument, California. Bull. So. California Acad. Sci. 66:1–22.

—, G. Bennett, S.R. Sanborn, C.H. Barbour, and H. Weiner. 1974. A handlist of the herpetofauna of Baja California and adjacent islands. Priv printed, California State Univ., Long Beach.

Lowe, C.H. 1964. The Vertebrates of Arizona. Univ. Arizona Press, Tucson.

— and P.C. Rosen. 1992. Ecology of the amphibians and reptiles of Organ Pipe National Monument, Arizona. Final Report Nat. Park Serv., Comp. Stud. Unit, Univ. Arizona, Tucson.

—, C.R. Schwalbe, and T.B. Johnson. 1986. The Venomous Reptiles of Arizona. Arizona Game Fish Dept., Phoenix.

Loza, E. 1999. The natural history and captive husbandry of the Shovelnose Snake. Rept. Amphib. Hobbyist 5(4):54–58.

Macey, J.R. 1986. The biogeography of a herpetofaunal transition between the Great Basin and Mojave Deserts, p. 119–128. *In* C.A. Hall and D.J. Young (eds.), Natural History of the White-Inyo Range,

Eastern California and Western Nevada, and High Altitude Physiology. Univ. California White Mountain Res. Sta. Symp., Bishop, California.

— and T.J. Papenfuss. 1991. Reptiles, p. 291–360. *In* C.A. Hall, Jr. (ed.), Natural History of the White-Inyo Range, Eastern California. California Nat. Hist. Guides No. 55, Univ. California Press, Berkeley.

Mahrdt, C.R. and B.H. Banta. 1996. *Chionactis occipitalis annulata*. Predation and diurnal activity. Herpetol. Rev. 27:81.

—, K.R. Beaman, P.C. Rosen, and P.A. Holm. 2001. *Chionactis*. Cat. Amer. Amphib. Rept. (729):1–6.

Mares, M.A., W.F. Blair, F.A. Enders, D. Greegor, A.C. Hulse, J.H. Hunt, D. Otte, R.D. Sage, and C.S. Tomoff. 1977. The strategies and community patterns of desert animals, p. 107–163, 267–271. *In* G.H. Orians and O.T. Solbrig (eds.), Convergent Evolution in Warm Deserts. Hutchinson and Ross, Stroudsburg, Pennsylvania.

Marlow, R. 1988. Western Shovel-nosed Snake, *Chionactis occipitalis*, p. 224–225. *In* D.C. Zeiner, W.F. Laudenslayer, Jr., and F.E. Mayer (eds.), California's Wildlife: Amphibians and Reptiles. Vol. 1. Dept. Fish Game, Sacramento, California.

Marx, H. and G.B. Rabb. 1972. Phyletic analysis of fifty characters of advanced snakes. Fieldiana Zool. 63:1–321.

Mattison, C. 1989. Notes on Shovel-nosed Snakes and Sand Snakes, *Chionactis* and *Chilomeniscus*. Brit. Herpetol. Soc. Bull. (28):25–30.

Mautz, W.J. 1982. Patterns of evaporative water loss, p. 443–481. *In* C. Gans and F.H. Pough (eds.), Biology of the Reptilia. Vol. 12. Physiology C. Acad. Press, New York.

Mayhew, W.W. 1983. Vertebrates and their habitats on the Deep Canyon transect. Philip L. Boyd Deep Canyon Desert Res. Ctr., Univ. California, Natural Land and Water Reserves System, Palm Desert.

McPeak, R. H. 2000. Amphibians and Reptiles of Baja California. Sea Challengers, Inc., Monterey, California.

Meek, S.E. 1905. An annotated list of a collection of reptiles from southern California and northern lower California. Field Columbian Mus., Zool. Ser. (104):1–19.

Mehrtens, J.M. 1987. Living Snakes of the World in Color. Sterling Publ. Co., New York.

Mertens, R. 1956. Das Problem der Mimikry bei Korallenschlangen. Zool. Jahrb., Abt. Syst. Ökol. Geogr. 84:541–576.

Miller, A.H. and R.C. Stebbins. 1964. The Lives of Desert Animals in Joshua Tree National Monument. Univ. California Press, Berkeley.

Miller, M.R. 1968. The cochlear duct of snakes. Proc. California Acad. Sci., 4th Ser., 35:425–476.

Mitchell, J.C. 1978. Balling behavior in *Chionactis occipitalis* (Reptilia, Serpentes, Colubridae). J. Herpetol. 12:435–436.

Moon, B. 1988. Biogeography of a desert mountain herpetofauna, the Providence Mountains, eastern Mojave Desert, California. Unpubl. undergrad. thesis, Univ. California, Santa Cruz.

Moore, J. and V. Koch. 1973. Amphibians and Reptiles of Joshua Tree National Monument. Joshua Tree Nat. Hist. Assoc., Twentynine Palms, California.

Morrison, M.L. and L.S. Hall. 1999. Habitat relationships of amphibians and reptiles in the Inyo-White Mountains, California and Nevada, p. 233–237. *In* S.B. Monsen and R. Stevens (eds.), Proceedings: Ecology and Management of Pinyon-juniper Communities within the Interior West, September 15–18, 1997, Provo, Utah. Proc. RMRS-P-9. U.S. Dept. Agric., For. Serv., Rocky Mtn. Res. Sta., Ogden, Utah.

Mosauer, W. 1932. Adaptive convergence in the sand reptiles of the Sahara and of California: a study in structure and behavior. Copeia 1932:72–78.

—. 1933. Locomotion and diurnal range of *Sonora occipitalis*, *Crotalus cerastes* and *Crotalus atrox* as seen from their tracks. Copeia 1933:14–16.

—. 1935. The reptiles of a sand dune area and its surroundings in the Colorado Desert, California: a study in habitat preferences. Ecology 16:13–27.

—. 1936. The reptilian fauna of the sand dune areas of the Vizcaino Desert and of northwestern lower California. Occ. Pap. Mus. Zool. Univ. Michigan (329):1–21.

Müller, F. 1882. Erster Nachtrag zum Katalog der herpetologischen Sammlung des Basler Museums. Verh. Naturf. Ges. Basel 7:120–165.

Murphy, R.W. 1976. The evolution of a peninsular and insular herpetofauna: A drift based alternate hypothesis. M.A. thesis, San Francisco St. Univ., San Francisco, California.

—. 1982. The genetic relationship and biogeography of the Baja California herpetofauna. Ph.D. Diss., Univ. California, Los Angeles.

—. 1983a. The reptiles: origins and evolution, p. 130–157. *In* T.J. Case and M.L. Cody (eds.), Island Biogeography in the Sea of Cortez. Univ. California Press, Berkeley.

—. 1983b. Paleobiogeography and genetic differentiation of the Baja California herpetofauna. Occ. Pap. California Acad. Sci. (137):1–48.

Mushinsky, H.R. 1987. Foraging ecology, p. 302–334. *In* R.A. Seigel, J.T. Collins, and S.S. Novak (eds.), Snakes: Ecology and Evolutionary Biology. McGraw-Hill, New York.

Norris, K.S. 1967. Color adaptation in desert reptiles and its thermal relationships, p. 162–229. *In* W.W. Milstead (ed.), Lizard Ecology: A Symposium. Univ. Missouri Press, Columbia.

— and K.L. Kavanau. 1966. The burrowing of the Western Shovel-nosed Snake, *Chionactis occipitalis* Hallowell, and the undersand environment. Copeia 1966:650–664.

Oliver, J.A. 1955. The Natural History of North American Amphibians and Reptiles. D. Van Nostrand, Princeton, New Jersey.

Pappenfuss, T.J. 1986. Amphibian and reptile diversity along elevational transects in the White-Inyo Range, p. 129–136. *In* C.A. Hall and D.J. Young (eds.), Natural History of the White-Inyo Range, Eastern California and Western Nevada, and High Altitude Physiology. Univ. California White Mountains Res. Sta. Symp., Bishop, California.

Perkins, C.B. 1938. The snakes of San Diego County with descriptions and key. Bull. Zool. Soc. San Diego (13):1–66.

—. 1940. A key to the snakes of the United States. Bull. Zool. Soc. San Diego (16):1–63.

—. 1949a. The snakes of San Diego County with descriptions and key. 2nd ed. Bull. Zool. Soc. San Diego (23):1–77.

—. 1949b. A key to the snakes of the United States. 2nd ed. Bull. Zool. Soc. San Diego (24):1–79.

Pickwell, G. 1947. Amphibians and Reptiles of the Pacific States. Stanford Univ. Press, Stanford, California.

Pough, F.H. 1969. The morphology of undersand respiration in reptiles. Herpetologica 25:216–233.

—. 1988. Mimicry and related phenomena, p. 153–234. *In* C. Gans and R.B. Huey (eds.), Biology of the Reptilia. Vol. 16. Ecology B, Defense and Life History. Alan R. Liss, Inc., New York.

—, R.M. Andrews, J.E. Cadle, M.L. Crump, A.H. Savitzky, and K.D. Wells. 1998. Herpetology. Prentice Hall, Upper Saddle River, New Jersey.

Powder, W.A. and R.B. Loomis. 1962. A new species and new records of chiggers (Acarina, Trombiculidae) from reptiles of southern California. J. Parasitol. 48:204–208.

Powell, R., J.T. Collins, and E.D. Hooper, Jr. 1998. A Key to Amphibians and Reptiles of the Continental United States and Canada. Univ. Kansas Press, Lawrence.

Pregill, G.K. and J.E. Berrian. 1984. Type specimens of amphibians and reptiles in the San Diego Natural History Museum. Trans. San Diego Soc. Nat. Hist. 20:151–164.

Price, R.M. 1982. Dorsal snake scale microglyphics: ecological indicator or taxonomic tool? J. Herpetol. 16:294–306.

— and P. Kelly. 1989. Microdermatoglyphics: basal patterns and transition zones. J. Herpetol. 23:244–261.

Richardson, C.H., Jr. 1910. Notes on a little-known species of snake, *Chionactis occipitalis*. Science 32:383–384.

Rosen, P.C. and C.H. Lowe. 1994. Highway mortality of snakes in the Sonoran Desert of southern Arizona. Biol. Conserv. 68:143–148.

— and —. 1996. Ecology of the amphibians and reptiles at Organ Pipe Cactus National Monument, Arizona. Tech. Report No. 53, Nat. Biol. Service, Cooperative Park Studies Unit, (USGS, Sonoran Desert Fld. Sta.), Univ. Arizona, Tucson and National Park Service, Organ Pipe Cactus National Monument.

—, P.A. Holm, and C.H. Lowe. 1996. Ecology and status of Shovel-nose Snakes (*Chionactis*) and Leafnose Snakes (*Phyllorhynchus*) at and near Organ Pipe Cactus National Mounument, Arizona. Final Report, Heritage Progr., Arizona Game Fish Dept., Phoenix.

Russell, F.E. 1980. Snake Venom Poisoning. J.B. Lippincott Co., Philadelphia, Pennsylvania.

—. 1983. Snake Venom Poisoning. 2nd ed. Scholium Intl., Inc., Great Neck, New York.

Saiff, E. 1975. Preglottal structures in the snake family Colubridae.

Copeia 1975:589–592.
Sanborn, S.R. and R.B. Loomis. 1976. Keys to the amphibians and reptiles of Baja California, Mexico, and the adjacent islands. Priv. printed, California St. Univ., Long Beach.
Savage, J.M. 1948. An Illustrated Key to the Lizards, Snakes, and Turtles of California. Naturegraph Pocket Keys, Los Altos, California.
—. 1949. An Illustrated Key to the Lizards, Snakes, and Turtles of the Western United States and Canada. Naturegraph Pocket Keys, Los Altos, California.
—. 1959. An Illustrated Key to the Lizards, Snakes and Turtles of the Western United States and Canada. Rev. ed. Naturegraph Co., San Martin, California.
Schmidt, K.P. 1922. The amphibians and reptiles of lower California and the neighboring islands. Bull. Amer. Mus. Nat. Hist. 46:607–707.
—. 1953. A Checklist of North American Amphibians and Reptiles. 6th ed. Amer. Soc. Ichthyol. Herpetol., Univ. Chicago Press, Chicago, Illinois.
— and D.D. Davis. 1941. Field Book of Snakes of the United States and Canada. G.P. Putnam's Sons, New York.
—, —, and H. Wermuth. 1971. Knaurs Tierreich in Farben: Reptilien. Chanticleer Press, Inc., New York.
Schoenherr, A.A. 1992. A Natural History of California. California Nat. Hist. Guide (56). Univ. California Press, Berkeley.
Scott, C. 1996. Snake Lover's Lifelist and Journal. Univ. Texas Press, Austin.
Seib, R.L. 1980. Baja California: a peninsula for rodents but not for reptiles. Amer. Nat. 115:613–620.
Shaw, C.E. 1953. A hibernating *Chionactis occipitalis annulatus*. Herpetologica 9:72.
— and S. Campbell. 1974. Snakes of the American West. Alfred A. Knopf, New York.
Simon, H. 1979. Easy Identification Guide to North American Snakes. Dodd and Mead Publ., New York.
Slama, D.E. 1963. An annotated check list of the snakes of San Bernardino County with a key to the species. Scientific Ser. (7), San Bernardino Co. Mus. Assoc. 10:1–40.
Slevin, J.R. 1934. A handbook of reptiles and amphibians of the Pacific states including certain eastern species. California Acad. Sci. Spec. Publ.:1–73.
—. 1951. The San Felipe road – a snake hunter's disappointment. Herpetologica 7:191–192.
— and A.E. Leviton. 1956. Holotype specimens of reptiles and amphibians in the collection of the California Academy of Sciences. Proc. California Acad. Sci. 28:529–560.
Sloan, A.J. 1965. Holotype specimens of reptiles in the collection of the San Diego Society of Natural History. Trans. San Diego Soc. Nat. Hist. 14:1–8.
Smith, H.M. and E.D. Brodie, Jr. 1982. A Guide to Field Identification: Reptiles of North America. Golden Press, New York.
— and R.L. Holland. 1971. Noteworthy snakes and lizards from Baja California. J. Herpetol. 5:56–59.
— and R.B. Smith. 1973. Synopsis of the Herpetofauna of Mexico. Vol. II. Analysis of the Literature Exclusive of the Mexican Axolotl. Eric Lundberg, Augusta, West Virginia.
— and —. 1976. Synopsis of the Herpetofauna of Mexico. Vol. III. Source Analysis and Index for Mexican Reptiles. John Johnson, North Bennington, Vermont.
— and E.H. Taylor. 1945. An annotated checklist and key to the snakes of Mexico. Bull. U.S. Natl. Mus. 187:iv + 239 p.
— and —. 1950. Type localities of Mexican reptiles and amphibians. Kansas Univ. Sci. Bull. 33:313–380.
— and —. 1966. Herpetology of Mexico. Annotated Checklists and Keys to the Amphibians and Reptiles. Eric Lundberg, Aston, Maryland.
Smith, P.W. and M.M. Hensley. 1958. Notes on a small collection of amphibians and reptiles from the vicinity of the Pinacate lava cap in northwestern Sonora, Mexico. Trans. Kansas Acad. Sci. 61:64–76.
Stebbins, R.C. 1954. Amphibians and Reptiles of Western North America. McGraw-Hill Book Co., New York.
—. 1966. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts.
—. 1972. Amphibians and Reptiles of California. Univ. California Press, Berkeley.
—. 1985. A Field Guide to Western Reptiles and Amphibians. 2nd ed. Houghton Mifflin Co., Boston, Massachusetts.
Stejneger, L. and T. Barbour. 1917. A Checklist of North American Amphibians and Reptiles. Harvard Univ. Press, Cambridge, Massachusetts.
— and —. 1923. A Checklist of North American Amphibians and Reptiles. 2nd ed. Harvard Univ. Press, Cambridge, Massachusetts.
— and —. 1933. A Checklist of North American Amphibians and Reptiles. 3rd ed. Harvard Univ. Press, Cambridge, Massachusetts.
— and —. 1939. A Checklist of North American Amphibians and Reptiles. 4th ed. Harvard Univ. Press, Cambridge, Massachusetts.
— and —. 1943. A Checklist of North American Amphibians and Reptiles. 5th ed. Harvard Univ. Press, Cambridge, Massachusetts.
Stephens, F. 1918. Some southern California reptile notes. Copeia 1918:34–35.
—. 1921. An annotated list of the amphibians and reptiles of San Diego County, California. Trans. San Diego Soc. Nat. Hist. 3:57–69.
Stewart, G.R. 1994. An overview of the Mohave Desert and its herpetofauna, p. 55–69. *In* P.R. Brown and J.W. Wright (eds.), Herpetology of North American Deserts: Proceedings of a Symposium. Southwest. Herpetol. Soc. Spec. Publ. (5):iv + 311 p.
Stickel, W.H. 1938. The snakes of the genus *Sonora* in the United States and lower California. Copeia 1938:182–190.
—. 1941. The subspecies of the Spade-nosed Snake, *Sonora occipitalis*. Bull. Chicago Acad. Sci. 6:135–140.
—. 1943. The Mexican snakes of the genera *Sonora* and *Chionactis* with notes on the status of other colubrid genera. Proc. Biol. Soc. Washington 56:109–128.
Stoops, E.D. and A. Wright. 1993. Snakes and Other Reptiles of the Southwest. Golden West Publ., Inc., Phoenix, Arizona.
Switak, K.H. 1973. The Care of Desert Reptiles. Karl H. Switak, West Nyack, New York.
—. 1978. Leben in der Wüste: *Chilomeniscus* und *Chionactis*, die Nattern, die im Sand Schwimmen. Aquar. Terrar Zeit. 12:355–359.
—. 1984. The Life of Desert Reptiles and Amphibians. Karl H. Switak, San Francisco, California.
—. 1986. Nattern, die im Sand schwimmen. Lebensraum, Verhalten und Pflege von Sand- und Schaufelnasennattern. Aquar. Mag. 20:388–391.
—. 1993. Nattern, die im Sand schwimmen. Den. Aquar. Terrar. Zeit. 12:778–781.
Tanner, W.W. and B.H. Banta. 1966. A systematic review of the Great Basin reptiles in the collection of Brigham Young University and the University of Utah. Great. Basin Nat. 26:87–135.
— and C.D. Jorgensen. 1963. Reptiles of the Nevada Test Site. Brigham Young Univ. Sci. Bull., Biol. Ser. 3:1–31.
Telford, S.R., Jr. 1970. A comparative study of endoparasitism among some southern California lizard populations. Amer. Midl. Natur. 83: 516–554.
Trinco, L.A. and H.M. Smith. 1972. The karyology of ophidians - a review. Trans. Kansas Acad. Sci. 74:138–146.
Turner, F.B. 1977. The dynamics of populations of squamates, crocodilians and rhynchocephalians, p. 157–264. *In* C. Gans and D. Tinkle (eds.), Biology of the Reptilia. Vol. 7. Ecology and Behavior. Acad. Press, New York.
— and R.H. Wauer. 1963. A survey of the herpetofauna of the Death Valley area. Great Basin Nat. 23:119–128.
Van Denburgh, J. 1897. The reptiles of the Pacific coast and Great Basin. Occ. Pap. California Acad. Sci. (5):1–236.
—. 1922. The reptiles of western North America. Vol. 2. Snakes and Turtles. Occ. Pap. California Acad. Sci. (10):617–1028.
— and J.R. Slevin. 1913. A list of the amphibians and reptiles of Arizona, with notes on the species in the collection of the Academy. Proc. California Acad. Sci. (4), 3:391–454.
Van Devender, T.R. 1990. Thoughts on the evolution of southwestern desert reptiles. Sonoran Herpetol. 3:51–56.
— and J.I. Mead. 1978. Early Miocene and Late Pleistocene amphibians and reptiles in Sonoran Desert packrat middens. Copeia 1978:464–475.
—, A.M. Rea, and W.E. Hall. 1991. Faunal analysis of Late Quaternary vertebrates from Organ Pipe Cactus National Monument, southeastern Arizona. Southwest. Nat. 36:94–106.
—, A.M. Rea, and M.L. Smith. 1985. An interglacial vertebrate fauna from Rancho La Brisca, Sonora, Mexico. Trans. San Diego Soc. Nat. Hist. 21:23–55.
Vitt, L.J. and A.C. Hulse. 1973. Observations on feeding habits and tail

display of the Sonoran Coral Snake, *Micruroides euryxanthus*. Herpetologica 29:302–304.

— and R.C. Ohmart. 1978. Herpetofauna of the lower Colorado River: Davis Dam to the Mexican border. Proc. West. Found. Vert. Zool. 2:33–72.

Wake, D.B. 1966. The colubrid snake genus *Chionactis* in Baja California, Mexico. Copeia 1966:364.

Warren, J.W. 1953. Notes on the behavior of *Chionactis occipitalis*. Herpetologica 9:121–124.

Welsh, H.H., Jr. 1976. Ecogeographic distribution of the herpetofauna of the Sierra San Pedro Martir region, Baja California del Norte, Mexico. M.S. thesis, Humboldt St. Univ., Arcata, California.

—. 1988. An ecogeographic analysis of the herpetofauna of the Sierra San Pedro Martir region, Baja California, with a contribution to the biogeography of the Baja California herpetofauna. Proc. California Acad. Sci. 46:1–72.

— and R.B. Bury. 1984. Additions to the herpetofauna of the south Colorado Desert, Baja California, with comments on the relationships of *Lichanura trivirgata*. Herpetol. Rev. 15:53–56.

Wright, A.H. and A.A. Wright. 1952. List of the snakes of the United States and Canada by states and provinces. Amer. Midl. Nat. 48:574–603.

— and —. 1957. Handbook of Snakes of the United States and Canada. Vol. 1. Comstock Publ. Assoc., Ithaca, New York.

Yarrow, H.C. 1882. Checklist of North American Reptilia and Batrachia. Bull. U.S. Natl. Mus. (24):1–249.

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